DOCUMENT RESUME

ED 229 280 SE 041 587

AUTHOR	Krajkovich, Joseph G.
TITLE	A Survey of Accidents in the Secondary School Science Laboratory.
INSTITUTION	New Jersey Science Supervisors Association.
PUB DATE	May 83
NOTE	26p.
AVAILABLE FROM	David Sousa, West Orange Board of Education, 22 Municipal Plaza, West Orange, NJ 07052 ($3.50).
PUB TYPE	Reports - Descriptive (141)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Accident Prevention; Accidents; *Injuries; Laboratory Procedures; *Laboratory Safety; Questionnaires; *School Accidents; Science Education; Science Equipment; Science Experiments; *Science Laboratories; Secondary Education; *Secondary School Science; State Surveys; Teacher Characteristics
IDENTIFIERS	New Jersey

ABSTRACT

A survey of 102 New Jersey secondary school science teachers, department chairpersons, and supervisors concerning their laboratory accident-rate was conducted during the 1981-82 school year. Results indicate that accidents occur on a weekly basis even among a sample of experienced teachers who were interested in safety. The number of accidents reported was 4,721, which is equivalent to 1.29 per teacher per week. Thirty-seven percent of the respondents reported a major accident had occurred in their teaching experience (one requiring a doctor's care). Other findings of importance were that laboratory facilities appear to be less than comprehensive in the area of eye safety and those teachers with advanced degrees and the most experiences have significantly fewer accidents. Questionnaire used in the survey, comments concerning survey question C2 ("Do you feel that authors forewarn you enough as to the safety of a proposed laboratory experiment?"), list of major accidents reported (from those included in the survey), and list of other accidents reported not included in the survey are provided in appendices. (JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

NEW JERSEY
SCIENCE SUPERVISORS ASSOCIATION

Affiliated with
NATIONAL SCIENCE
SUPERVISORS ASSOCIATION
and
NEW JERSEY
SCIENCE TEACHERS ASSOCIATION

A SURVEY OF ACCIDENTS
IN THE
SECONDARY SCHOOL SCIENCE LABORATORY

by

Joseph G. Krajkovich, Ed.D.
Supervisor of Science
Edison Township Public Schools
Edison, New Jersey

Copyright © 1983 New Jersey Science Supervisors Association

TABLE OF CONTENTS

	Page
Abstract	1
Introduction	1
Methods and Procedures	1
Sample	2
Results [Demographics]	3
Facilities	6
Lab Safety	7
Major Accidents	7
Accident Rate	7
Accidents Most Likely To Occur	9
Laboratory Accident Correlations	10
Analysis	10
Laboratory Size	11
Eye Safety	11
Education and Experience Are Important	12
Conclusion	12

A SURVEY OF ACCIDENTS
in the
SECONDARY SCHOOL SCIENCE LABORATORY

Abstract

A survey of 102 secondary school science teachers, department chairpersons and supervisors concerning their laboratory accident-rate was conducted during the 1980-1981 school year. The results indicate that accidents occur on a weekly basis even among a sample of experienced teachers, interested in safety. Four-thousand, seven-hundred and twenty-one accidents were reported which is equivalent to 1.29 per teacher per week. Thirty-seven per cent of the respondents reported a major accident had occurred in their teaching experience (one requiring a doctor's care).

Other findings of importance were that laboratory facilities appear to be less than comprehensive in the area of eye safety and those teachers with advanced degrees and the most experience have significantly fewer accidents.

Introduction

How often do accidents occur in the secondary school science classroom? This is a question often expressed by science teachers when laboratory safety is discussed. The answer is elusive since most states do not accumulate laboratory accident data and the research is sparse. Macomber (1961) and Young (1970, 1972) examined chemistry classes in California and Illinois and although their results are helpful, they are specific to chemistry. Furthermore, since curriculum changes may affect the accident rate, a more recent study is necessary.

Methods and Procedures

A questionnaire was developed based largely upon the research by Young (1972). (See Appendix A) In order to make the survey simple to complete,

a list of typical accidents was presented to which the respondents could simply check the number of times per week, month, or year the accident occurred. Space was provided for write-in accidents that were not listed. The listed accidents were based on Young's study, plus others that typically occur outside of chemistry.

Information concerning the respondent's age, sex, years in education, degree, grade-level taught, and subject area was also obtained. In addition, questions concerning the facilities were asked, i.e. size of laboratory, class size and types of safety devices present in the laboratory.

Several other questions were also asked about safety in general such as "Do you feel that authors forewarn you enough as to the safety of a proposed laboratory experiment?"

Sample

The sample consisted of members of the New Jersey Science Supervisors Association and teachers attending safety workshops presented by the author. Seventy-one questionnaires were returned by association members and 31 were completed as the first part of a safety workshop.

Randomness was not an important factor in the study as the sample indicates. Members of a science supervisory association are generally experienced teachers with an interest in science as their membership would indicate. The teachers attending a science safety workshop are interested in learning about safety and, therefore, might be biased in the direciton of providing a safe environment for their students. Although, this sample may not reflect the typical science teacher of New Jersey, its bias is toward safety. This means that the results would be the best one could expect and, therefore, the results are valuable as a means of comparison.

Results

Demographics

Of the 102 respondents, 59 were male and 39 were female (4 did not respond to the question). Fifty-one were science teachers, 43 were department heads and 8 were science supervisors. The educators ranged from one to 45 years in education (mean = 16.8) and ranged in age from 22 to 66 (mean = 40.9).

TABLE 1

Demographics

	Number
Respondents	102
Male	59]*
Female	39]
Teachers	51
Department Heads	43
Supervisors	8
Average Age	40.9
Average Number of Years in Education	16.8

*4 did not respond

Demographics (Cont'd)

The participants were remarkably well educated in that 83 had obtained a minimum of a master's degree; 5 had obtained doctorates' and 58 of the 83 had a minimum of thirty credits above the master's degree. Seventeen teachers had only a B.S. degree.

TABLE 2

Highest Degree Held

Degree	Number
B.S.	17
Masters	6
+10	8
+20	6
+30	14
+40	20
+50	7
+60	17
Ph.D.	5

Demographics (Cont'd)

Fifty-eight of the teachers taught chemistry, biology - 23, physics - 6, earth science - 7, general science - 3, and other science - 3. These courses were taught at the following grade levels: seventh - 2, eight - 10, ninth - 6, tenth - 19, eleventh - 51, twelfth - 11.

TABLE 3

Subject Taught

Subject	Number
Biology	23
Chemistry	56
Physics	6
Earth Science	7
General Science	3
Other	3

TABLE 4

Grade Level Taught

Grade Level	Number
7	2
8	10
9	6
10	19
11	51
12	11

Facilities

The approximate square footage of the laboratory or classroom in which science was taught was 938 sq. ft. (about a 30 ft. x 30 ft. room). Only one of the responses indicated that their room did not contain a fire-extinguisher, whereas 19 did not have fire blankets, 55 did not have showers, 35 did not contain fume-hoods, 42 did not have portable eye-wash stations and 52 did not contain permanent eye-wash stations. Seven classes did not have safety safety goggles, whereas, 53 did not have goggle sterilizers.

TABLE 5

Safety Equipment Present

Equipment	Yes	No
Fire Extinguisher	101	1
Fire Blanket	83	19
Shower	47	55
Fume Hood	67	35
Portable eye wash station	60	42
Permanent eye wash station	50	52
Safety Goggles	95	7
Goggle Sterilizer	49	53

The average class size reported was 22-23 with a range from 11 to 32.

Lab Safety

Approximately half of the population surveyed had attended a lab safety workshop and 70 per cent were familiar with the liability aspects associated with science teaching. Ninety-nine of the 101 responded positively to the question "Do you enforce the wearing of safety goggles?", but 46 said it was difficult to do so.

The vast majority devoted at least one lesson to laboratory safety (99 - yes; 2 - no) and 58 said they felt that authors did not do enough to forewarn teachers of potential hazards in a laboratory investigation. (See Appendix B for other comments concerning textbook warnings.)

Major Accidents

One of the most interesting questions asked by Young in 1969 was "In your teaching experience, have you ever encountered a serious laboratory accident (one which required a physician for a student or yourself). If yes, please comment on the cause of the problem and the result of the injury." Over fifty per cent of the 203 teachers who responded in 1969 said yes to that question.

The question was also asked in this study with 36 of the 101 respondents saying yes. (See Appendix C for a detailed listing of the accidents reported) Twenty-seven per cent of the accidents listed involved eye injuries and 22% of the major accidents were caused by improperly inserting glass tubing into rubber stoppers.

Accident Rate

If the list of accidents is perused, it becomes apparent that some are obviously injury related (burns from hot glass tubing), while others involve equipment management (flying objects from heated test tubes). In order

to properly report the results the accident rate was determined for all accidents. However, the accident list was also divided into two separate groups (injury related and laboratory accidents), then the accident rate was recalculated in order to give a more detailed report.

The accident rate was calculated by determining the number of encounters per year and dividing by 102 which represents the number of respondents. (See Appendix D for additional accidents)

The total number of accidents reported by the 102 respondents for the 1980-81 school year was 4721. This represents 46.28 accidents per year or 1.29 per week. When the list is divided into two groups as discussed above, the injury related accidents equaled 1545 or 15.06 per year per case. The other laboratory accidents totaled 3166 or 31.03 per year per case.

TABLE 6

Laboratory Accident Rate in 1980-1981

Total Accidents	n	Per Year/Per Case	Per Week/Per Case
4721	102	46.28	1.29

Injury Related Accidents

Total Accidents	n	Per Case/Per Year	Per Case/Per Week
1545	102	15.06	0.42

Other Laboratory Accidents

Total Accidents	n	Per Case/Per Year	Per Case/Per Week
3166	102	31.03	0.86

Accidents Most Likely To Occur

When the results of the survey are examined, several accidents clearly are responsible for the bulk of the reported accidents. Once again if these are separated into two groups - injury related and other accidents - burns are responsible for four of the top five accidents and cuts from handling glass tubing was the third most reported injury related accident.

TABLE 7

Top Five Injury Related Accidents

	Total Reported	# Per Year/ Per Case
1. Burns from hot glass tubing	454	4.45
2. Burns or irritations from acids or bases	265	2.59
3. Cuts from handling glass tubing	198	1.94
4. Burns from burners	183	1.79
5. Burns (other)	144	1.41

Other laboratory accidents were generally caused by horseplay in the lab of students not following instructions.

TABLE 8

Top Five Laboratory Accidents

	Total Reported	# Per Year/ Per Case
1. Horseplay in the lab	899	8.81
2. Returning of unused chemicals to wrong regent bottles	693	6.79
3. Improper heating of test tubes containing solids or liquids	390	3.82
4. Fires	321	3.14
5. Improper selection of chemicals (misreading labels)	270	2.65

Laboratory Accident Correlations

In an effort to determine whether the number of laboratory accidents correlated to any of the information obtained on the questionnaire, Pearson Correlations were calculated using the total number of accidents versus the following: sex, years in education, subject taught, grade level, degree level, age, size of classroom, and class size.

The only significant correlations occurred with the number of years in education ($p = 0.01$) and the degree level ($p = 0.001$). The more educated and more experienced teacher had significantly fewer accidents.

TABLE 9

Pearson Correlation Coefficients

	Sex	Years in *Education	Subject Taught	Grade Level	*Degree	Age	Room Size	Class Size
Total Accidents	0.0760	-0.2189	-0.0513	0.1638	-0.3158	-0.1870	0.0552	0.0550
	(98)	(100)	(100)	(99)	(100)	(92)	(78)	(101)
	P=0.228	P=0.014	P=0.306	P=0.053	P=0.001	P=0.037	P=0.316	P=0.292

*Significant to .01 or higher

Analysis

Accidents do occur in the secondary school science laboratory. They occur at a rate that is significant and at a rate above which most teachers suspect. The majority are not injury related and are caused by carelessness.

Of those that are injury-related the majority are caused by burns when students attempt to pick up objects that are still hot without protecting their hands. The other major category are cuts from glass tubing and glassware.

Remarkably over 37% of the teachers in this survey had experienced a major accident which required the attention of a doctor. The majority of these accidents were injuries to the eye (27%) which confirms the importance of eye protection devices.

The other accidents that caused considerable problems were injuries that occurred when inserting glass tubing into a rubber stopper. Twenty-two per cent of the major accidents reported involved this activity. This coupled with the large number of minor cuts from glass tubing reported, suggest a more careful look at the importance of the exercise versus the potential dangers. Certainly, at the very least, the activity should be eliminated at the middle school and extra care be given at the high school level.

Laboratory Size

The average size of the typical science laboratory was 938 sq. ft. with the average number of students in a class reported at 22-23. This gives each student approximately 42 sq. ft., which is within the recommended (40-50 sq. ft. per student) range. The size of the lab did not correlate significantly to the number of accidents, however, this should not be misconstrued as meaning that the size of the room does not make a difference. When individual surveys were examined, the vast majority of labs were of ample size. The few that appeared small were too few to influence the overall correlation. Furthermore, there is some question as to the accuracy of some of the smaller sizes reported. (One survey indicated a room size of 270 sq. ft. for 22 students!)

Eye Safety

There is a concern regarding the kind of safety equipment present. Sixteen per cent of the teachers reported neither a portable or permanent eye wash station present. Furthermore, more than half did not have goggle

sterilization equipment available. Considering the importance of eye safety and the likelihood of an accident involving the eyes occurring as proven by this survey, this area should be examine carefully by teachers and administrators alike.

Education and Experience Are Important

Of all the correlations among the total number of accidents versus the other variables reported the most significant was educational level followed by experience. Apparently, teachers become more cautious as they obtain more education and as they gather more experience in the classroom.

Conclusion

This study indicates that even among an experienced, highly educated group of science teachers accidents can and do occur. It behooves us all to become introspective concerning our approach to safety.

Since those teachers with the most experience and those with advanced degrees are less likely to have accidents, their expertise should be called for to assist in developing safety policies and procedures for the department and school district.

Particular attention should be paid to eye protection, ensuring that eye protection devices are present and that the means for their sterilization are obtained. Furthermore, eye wash stations should be present in all science labs.

Experiments involving glass tubing should be carefully examined for potential dangers. These hazards should be emphasized to the students. The insertion of glass tubing into rubber stoppers should be completed only at the high school level with particular care. At the middle school level, if the apparatus is necessary, it should be assembled by the teacher.

APPENDIX A

LAB SAFETY SURVEY

A. IN ORDER TO OBTAIN THE MOST ACCURATE INFORMATION, PLEASE BE SURE THAT EACH QUESTION IS ANSWERED. SIMPLY CHECK THOSE ANSWERS THAT ARE MULTIPLE CHOICE.

1. Male ___ Female___

2. Job title_____

3. Number of years in education (including this year)_____

4. Subject currently teaching (select the subject that has the most contact hours) Biology____; Chemistry____; Physics____; Earth Science____; Other(please specify) _____.

5. What grade level do you teach the subject selected in number 4 above? _____

6. Highest degree held: BS___; Masters___; Masters+10___; +20____; +30____; +40____; +50____; +60____; Doctorate_____.

7. What was your undergraduate major?_____

8. What was your graduate major?_____

9. Age_____

B. SAFETY EQUIPMENT - USING THE ROOM THAT IS CONSIDERED YOUR LABORATORY* , PLACE A CHECK NEXT TO THE SAFETY EQUIPMENT PRESENT.

1. Fire extinguisher____

2. Fire blanket____

3. Shower____

4. Fume hood____

5. Portable eye wash station____

6. Permanent eye wash station (one attached to plumbing)____

7. Safety goggles____

8. Goggle sterilizer____

9. Other (please specify)_____
_____

*10. What is the approximate square footage of this room? _____

COMMENTS:_____

_____

_____

C. LAB SAFETY

1. In your teaching experience, have you ever encountered a a serious laboratory accident (one which required a physician for a student or yourself) ___yes ___no. If yes, please comment on the cause of the problem and the result of the injury._____

_____

_____

_____

_____

2. Do you feel that authors forewarn you enough as to the safety of a proposed laboratory experiment? ___yes___no.

COMMENTS:_____

_____

3. Do you devote at least one lecture to the discussion of safety and of simple laboratory techniques? ___yes___no.

COMMENTS:_____

_____

4. Do you enforce the wearing of safety goggles? ___yes___no. If yes, do you find it difficult to enforce? ___yes___no.

COMMENTS:_____

5. Are you familiar with the amount of liability an instructor is under while in a laboratory situation? ___yes___no.

COMMENTS:_____

6. What is your average class size?_____

7. How many students are in your most populated class?_____

8. What is the average class size in the room selected as your laboratory in Part B? _____

9. Have you ever attended a lab safety workshop?___yes___no. If yes, where and when?_____

_____

IN THE NEXT SECTION WE ARE TRYING TO DETERMINE THE FREQUENCY AND TYPE OF ACCIDENTS THAT OCCUR IN THE TYPICAL SCIENCE CLASSROOM. PLEASE USE THE SAME ROOM SELECTED IN PART B (AS THE LABORATORY) AS THE SITE OF THE ACCIDENTS. FURTHERMORE, THE NUMBERS ARE SUPPOSED TO INDICATE FREQUENCY PER CLASS. THEREFORE, IF MORE THAN ONE CLASS MEETS IN THE LAB GIVE THE AVERAGE NUMBER OF ACCIDENTS - EITHER MAJOR OR MINOR.

D. FREQUENCIES OF LABORATORY ACCIDENTS

Listed below are several typical laboratory accidents. Please circle how many times per week, month or year, each accident occurred during this past school year. Please add any other incidents not listed.

For example, if a particular accident happens a great deal, then x number per week would be circled. However, if monthly is more appropriate, circle x number per month; if an accident occurs less than 10 times per year, then yearly is the correct interval.

(IF THE ACCIDENT DID NOT OCCUR THEN JUST OMIT THE ITEM.)

PROBLEMS	NUMBER OF ENCOUNTERS	CORRECT INTERVAL
1. Burns from hot glass tubing	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
2. Burns from burners	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
3. Burns or irritations from acids or bases	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
4. Burns (other)	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
5. Improper dilution of acids or bases with water	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
6. Cuts from handling of glass tubing	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
7. Cuts from the forcing of glass tubing or thistle tubes	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
8. Improper heating of test tubes containing solids or liquids	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
9. Flying objects from heated test tubes	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
10. Improper testing of vapors	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
11. Transferring of dangerous liquids by pipetting	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
12. Fires	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
13. Improper selection of chemicals(misreading labels)	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
14. returning of unused chemicals to wrong reagent bottles	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR

PROBLEMS	NUMBER OF ENCOUNTERS	CORRECT INTERVAL
15. Explosions due to the improper mixing of the wrong chemicals	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
16. Unauthorized experimentation	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
17. Tasting of chemicals by students	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
18. Animal bites or scratches	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
19. Poisoning from contact with mercuric oxide or other chemicals	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
20. Horseplay in the lab	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
21. Falls	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
22. Accidents involving long hair (singes)	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
23. Preservative splashes(dissecting)	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
24. Cuts from scissors or scalpels	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
25. Electrical shocks	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
26. Injury occurring on field trips	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
27. projectile injury caused by pick axe	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
28. Others:_____	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
29._____	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
30._____	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
31._____	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
32._____	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
33._____	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR
34._____	1 2 3 4 5 6 7 8 9 10 or More	WEEK MONTH YEAR

ADDITIONAL COMMENTS_____

This survey is based on a similar study completed by John Young in Illinois in 1970 and 1972. (Chem. Educ., 47:9)

APPENDIX B

Comments Concerning Question C2: "Do You Feel That Authors Forewarn You Enough As To The Safety Of A Proposed Laboratory Experiment?"

1. "Authors should include suggestions and information on what should be done if an accident occurs in that particular lab."
2. "When they say caution - give a more accurate description of the hazardous use of chem."
3. "In current sources yes, in older ones, no."
4. "Only a few publishers have attempted to include such info."
5. "The trend is beginning to go in the opposite direction."
6. "As much as possible most authors attempt to warn about dangers in lab."
7. "No, because I am very safety conscious I check all labs very carefully. However, I feel that many labs written in lab books are very dangerous and not so labeled."
8. "Most do not - some new texts are better."
9. "Little or no mention of hazards."

APPENDIX C

List of Major Accidents Reported

1. Blowout of reaction vessel which sprayed H_2SO_4 over 2 students (in eyes of both unprotected and going under a shield) no permanent injury - washed free for 30 seconds by me.
2. Acid in student's eye - no permanent damage.
3. Cut hand while inserting a glass tube in a stopper.
4. OH burns due to NaOH spilled when a beaker broke during stirring.
5. [1] Glass tubing through a hand; [2] Nitric acid spill.
6. Student grinding potassium chlorate.
7. [1] Inserting glass tubing into a rubber stopper; [2] hot aqua regia splashed into student's eye - no serious (permanent) damage.
8. [1] Student poured liquid bromine over his hand - hand seriously injured; [2] Sodium hydroxide and organic liquid boiling flask blew up - eyes badly burned - complete recovery.
9. Potassium Permanagenate dust in eye - sent to doctor.
10. A test tube containing $KCLO_3$ and MnO_2 broke causing 3rd degree burn in teacher's hand - the test tube was not pyrex.
11. [1] Student ran glass tubing into hand; [2] Teacher cut finger and thumb when the top of a chemical container broke off.
12. A student splashed dilute nitric acid on his face - slight discoloration for two week period.
13. [1] A student stole a small jar of ($AgNO_3$) which somehow spilled on his clothes. We caught him, took off his clothes and washed him down. Later, he put on the same belt that had absorbed the Silver Nitrate. Over the weekend the chemical continued to burn his skin. The wound was on the hip bone down to the knee. He required medical attention. He was photosensitive for about 6 months and also developed a grey skin color. The parents did not sue since the student stole the chemical. He has a permanent scar on his hip.

13. [2] Student sitting in front row had eye (cornea) burned by a drop of acid. The teacher was doing a demonstration at the front of the room. He dumped the acid into the sink which was cluttered with dirty beakers. The acid splattered up and splashed a student who was sitting in the front row. The cornea was permanently scared in a small spot. Parents sued and settled out of court.

    [3] Lab technician was attempting to dispose of HCl from a demonstration. Even though this was completed slowly with plenty of dilution the vapors were inhaled and she suffered a mild burn in the upper respiratory system. Taken to the hospital and administered O_2. Suffered discomfort for about 3 weeks.
14. Broken glass - cut hand.
15. Student forgot to wrap glass tubing with safety cloth before inserting in rubber stopper - tubing broke and ran through his hand.
16. Improper technique of placing a glass tube in a rubber stopper. The glass tubing was forced and broken and subsequently severely cut a student and required surgery.
17. Student had removed concentrated HNO_3 from the specific work area and tried to use the acid at his seat to dissolve a brass gram mass; the acid spilled on his leg causing 2nd degree burns.
18. Burned by liquid paradichloro benzene while helping a student.
19. Glass stirring rod snapped and cut index finger resulting in stitches.
20. Concentrated HCl splash in eye - rapid wash-out physician approved.
21. Thistle tube through hand - physician applied stitches.
    When teaching chemistry 20 years ago a thistle tube was broken on insertion into a 2 hole rubber stopper cutting student's hand badly, a result of fooling around and not working seriously.
22. Students carelessly dealing with sodium and potassium. Use of K with H_2O instead of $Na+H_2O$ led to an unexpectedly violent reaction. The base solution splashed in eyes of 2 students, who were rushed to the emergency room of a hospital for treatment. Students should have been wearing goggles, but they had taken them off to have a "closer-

look." (Same teacher said no to #4 "I find goggles to be more of a distraction in most experiments than the safety hazards demand.")

23. Student got some H_2SO_4 (conc.) on her arm. The beaker slipped while pouring.
24. Student pushed glass into finger. School insurance covered accident.
25. Small piece of glass in eye - capillary tube closed at both ends exploded upon heating. It should have been open at one end.
26. [1] Serious burn by boiling water. The student was taken to the hospital for a burn on the arm. [2] Law suit was settled out of court when student received a NaOH burn on her forearm. Negligence was not proven.
27. A faulty lab set-up caused a ring stand to fall breaking a beaker of hot solution burning a student's skin.
28. Student spilled acid on himself. Immediately used safety shower.
29. Students were stealing chemicals from semimicro kits and put all pilferage into 1 test tube which caused an explosion.
30. Student failed to have goggles on - got organic solvent in his eye
31. Student spilled conc. H_2SO_4 on legs.
32. I was supposed to be generating oxygen according to the lab directions but generated chlorine instead. Small boy had 2 hour coughing fit.
33. Can of sodium exploded as it was opened in the air. A fire resulted and a few pieces of sodium flew into the face. No permanent damage.
34. Glassware broken and piercing palm of student's hand.
35. Improper storage of acid (mayonnaise jar). The bottle dropped and bounced back causing eye damage from splashing. (The proper goggles were provided)
36. Cut finger required stitches.

APPENDIX D

Other Accidents Reported That Did Not Appear On The List

Accident	
Cuts from broken glassware	2/year
Breaking of glass	30/year
Dissecting needle punctures	3/year
Microscope mirror focused directly to sun	3/year
Missing hazardous chemical	1/year
Improper technique for lighting bunsen burner	20/year
Spillage due to tipping over reagent bottles	30/year
Misuse of lab apparatus	10/year
Disregard for safety of others	10/year
Spilling of hot liquid	1/year
Breaking glass thermometers	7/year
Injury from spills-irritation	2/year
Broken glass/cuts-scratches-	2/year

REFERENCES

Macomber, Robert D., Chemistry accidents in high school. Journal of Chemical Education, 1961, 38 (7), 367-368.

Young, John R., A survey of safety in high school chemistry laboratories of Illinois. Journal of Chemical Education, 1970, 47 (12), A829-838.

Young, John R., A second survey of safety in Illinois high school laboratories. Journal of Chemical Education, 1972, 49 (1), 55.